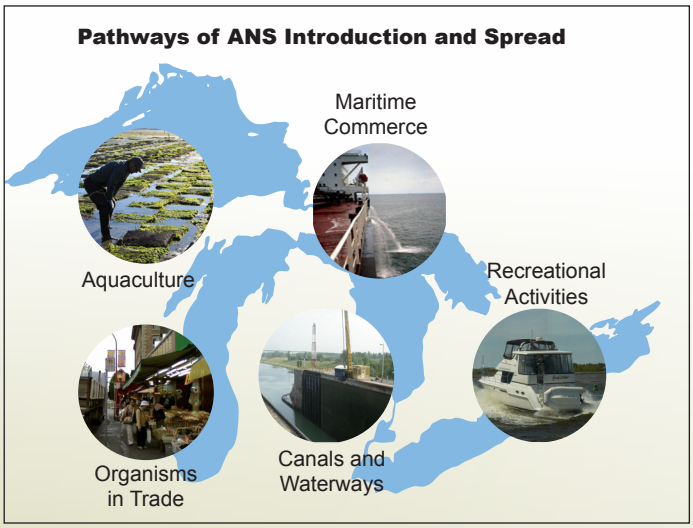
NOAA research targets Aquatic Nuisance Species in the GREAT LAKES

The Great Lakes, a highly valued freshwater resource, is renowned for sport and commercial fishing, recreation and tourism, transportation, as well as a source of high quality water for drinking, among other ecosystem services. The ecological and economic health of the Great Lakes continues to be threatened by the impacts of nonidigenous ***aquatic nuisance species*** (ANS).

Nonindigenous species, also known as non-native species, are organisms (plants, animals and microbes) found living beyond their historic native range, which is the area where the species evolved to its present form. Nonindigenous species are considered to be a nuisance or invasive species when their introduction and spread cause economic or environmental harm or harm to human health.[1] The impacts of invasive species of greatest concern include threats to the diversity or abundance of native species, the ecological stability of infested waters, and the commercial, agricultural and recreational activities dependent on such waters.[2]

Since the mid-1800s, ANS have invaded the Great Lakes from waters around the globe. The invasion of zebra mussels, followed by quagga mussels during the 1980s, are considered among the most harmful ANS that have become established as reproducing populations in the Great Lakes. Native to Eastern Europe, the zebra and quagga mussels – members of the dreissenid family – entered the Great Lakes from the discharge of ballast water of ships. Both species quickly spread throughout the basin, causing widespread ecological and economic damage.

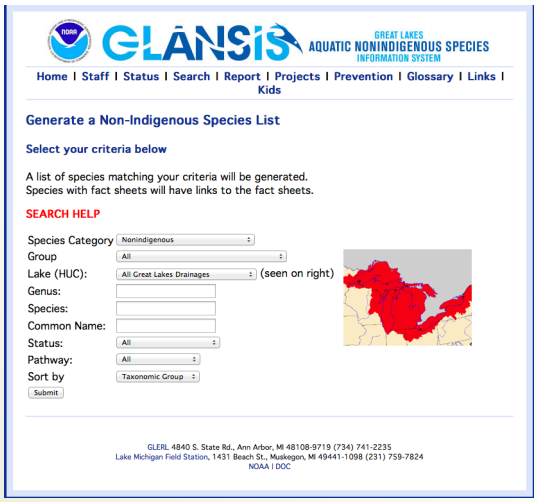
More than 182 ANS have been reported to have reproducing populations in the Great Lakes basin. The primary pathways of ANS introduction and spread include maritime commerce, canals and waterways, organisms in trade, recreational activities, and public and private aquaculture. Each of these pathways requires specific strategies to reduce the risk of ANS introduction and spread into the Great Lakes.



Great Lakes ANS Information System

To meet the challenges of managing ANS threats and informing the public of these threats, the NOAA Great Lakes Environmental Research Laboratory (GLERL) has created the database, Great Lakes ANS Information System (GLANSIS). Serving as a critical source of species-specific information, GLANSIS houses a core list of ANS to the Great Lakes basin that are not native to any part of the basin. Extremely valuable to ANS prevention efforts is the GLANSIS Watchlist – a list of species currently not found in the Great Lakes but assessed as likely to invade via current pathways based on peer reviewed scientific literature. GLANSIS, functioning as a Great Lakes node of the national U.S. Geological Service (USGS) Nonindigenous Aquatic Species (NAS) database, is searchable geographically (by watershed and lake) as well as by scientific and common name.

Search results from GLANSIS are available in a table including a thumbnail photo, taxonomy, continent of origin, and year first collected in the Great Lakes basin. Each record in the table is linked to a fact sheet that is generated from the latest



[1]Executive Order 13112 on Invasive Species. Feb. 3, 1999.
[2]Public Law 101-636 (*Nonidigenous Aquatic Nuisance Prevention and Control Act of 1990*).

information in the USGS NAS database — including point maps of species distributions. To further explore GLANSIS, see: www.glerl.noaa.gov/res/Programs/glansis/glansis.html.

NOAA RESEARCH

Scientists at NOAA GLERL conduct research to better understand the impacts of established ANS and potential invaders on the Watchlist. Lessons learned from their research support efforts to adaptively manage the Great Lakes and maintain important ecosystem services, such as fisheries production and water quality. Toward this end, GLERL is developing scenario forecasts of ANS impacts in conjunction with other stressors, such as nutrient loading and climate change. Forecasting enables the scientists to "experience" different scenarios of the future that will help to better understand and adapt to the consequences of ANS invasions. Critically important to this work is GLERL's collection of long-term ecological data, targeted fundamental research on ecosystem processes, and physical and ecological modeling.

Mussel Abundance and Food Web Impacts

Research and long-term monitoring programs on dreissenids, including both zebra and quagga mussels, and their impact on the Great Lakes ecosystem is a high priority at GLERL.

GLERL scientists continue long-term observations of dreissenid mussels' abundance in the Great Lakes and mussel interactions with nutrients, phytoplankton, zooplankton, and other components of the food web. GLERL's long-term observations in Lake Michigan coupled with experimental work on mussel feeding, nutrient excretion, and other processes help to explain changes in food web interactions. The widespread expansion of dreissenid populations to all depths, together with their high filtration rates, have decimated the spring phytoplankton bloom, decreasing the abundance of phytoplankton available to the food web in deep water during the summer. In addition to these impacts, the invasive mussels have reengineered the ecology of the entire food web by increasing water clarity and altering nutrient cycling. It is believed this reengineering has led to nuisance and harmful algal blooms in the nearshore zone and starvation of the offshore pelagic (open-water) food web, jeopardizing the valuable salmon fishery. Observations and process studies results are being used to develop models of dreissenid mussel impacts on the ecosystem.

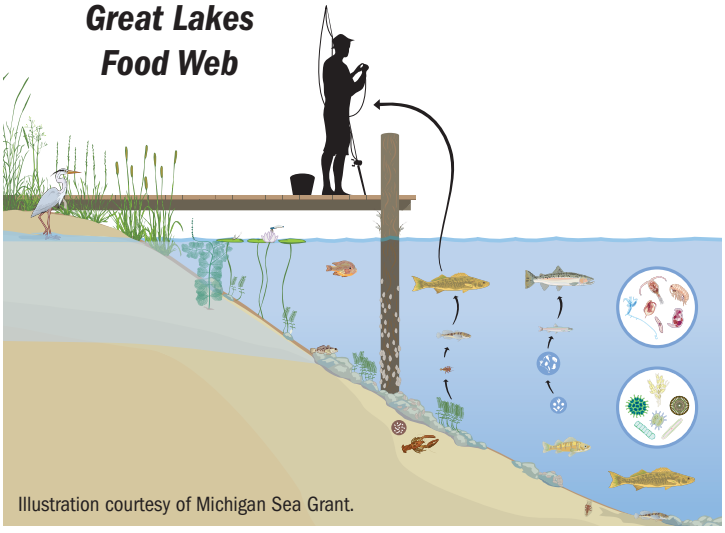


Illustration courtesy of Michigan Sea Grant.

Outcomes from GLERL research and monitoring of dreissenids and benthic (bottom-dwelling) animals and the pelagic food web will provide valuable information and modeling tools to resource managers and decision makers necessary to adaptively manage Great Lakes fisheries, water quality, and other ecosystem services.

Forecasting Impacts of Future Invasive Species on Great Lakes Food Webs and Fisheries

GLERL is collaborating with a group of research scientists to assess the risks posed by Asian carp, northern snakehead, hydrilla, golden mussel, killer shrimp, and other future invasive species to the Great Lakes ecosystem. These research partners represent the University of Michigan Cooperative Research for Limnology and Ecosystem Research (CILER), University of Notre Dame, University of Wyoming, The Nature Conservancy, the U.S. Forest Service, and Resources for the Future. The collaborative research provides valuable information to support regional efforts for preventing the introduction and spread of invasive species in the Great Lakes.

There is widespread concern that if new invasives such as Asian carp invade the Great Lakes, their rapid growth and voracious consumption habits could severely impair the Great Lakes ecosystem and economy. In response, GLERL and its research partners are developing risk-based models of invasive species abundance, dispersal, and bioeconomic impact to:

- assess the ability of likely new invasive species to reproduce, survive, and grow in Great Lakes habitats using the densities of prey and suitability of habitats
- determine the potential impacts of new invasive species on population dynamics, biomass, and harvest of important native and state-managed fisheries

This research will generate valuable data to predict: 1) Great Lakes habitats in which new invasive species can successfully grow, survive, and reproduce; and 2) determine the impact of new invasive species on food webs, key fish species, and fisheries in different Great Lakes environments. These predictions will assist resource managers and decision makers in prioritizing efforts for preventing the introduction and spread of invasive species into the Great Lakes.

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